

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE																					
BRIEF/WAIST ASSEMBLY, ITEM 104 ----- 0104-210605- 07/08/09/10/11/12 (1)	2/1R	104FM15 Loss of primary axial restraint bracket, lower side. Defective Material: Bracket, screw, helicoil or thread lock adhesive. Missing screw.	END ITEM: Loss of primary axial restraint. GFE INTERFACE: Axial load will be transferred to secondary restraint bracket. MISSION: None. CREW/VEHICLE: None with single failure. Loss of crewman with loss of secondary restraint bracket. TIME TO EFFECT /ACTIONS: Minutes. TIME AVAILABLE: Days. TIME REQUIRED: Hours. REDUNDANCY SCREENS: A-PASS B-N/A C-PASS	A. Design - The waist bearing lower side primary bracket is fabricated from 17-4 stainless steel. The brackets are machined or cast/machined, ultrasonic cleaned, passivated and either electropolished or dry hone finished. During tensile testing of the aluminum waist bearing, the lower side axial restraint bracket exhibited a minimum strength of 2500 lbs., demonstrating a minimum safety factor of 4.2 against a S/AD limit load of 593 lbs. The required S/AD minimum safety factor for waist hardware is 2.0. The bracket attachment screws are fabricated from A-286 stainless steel and are procured to MS or NAS specifications. Analysis showed an ultimate safety factor of 4.9 for screw thread shearout. Loss of the waist bearing lower side bracket screw is precluded by adherence to standard engineering torque requirements for screw installation and the use of thread lock adhesive. Design requirements for proper installation of helicoils are specified in the assembly procedures when the helicoils are installed in the waist bearing. B. Test - Acceptance: Component - See Inspection. PDA: The following test is conducted at the LTA level in accordance with ILC Document 0111-710112: Proof pressure test at 8.0 + 0.2 - 0.0 psig for a minimum of 5 minutes conducted with the TMG removed. Certification: The waist bearing primary brackets were successfully tested (manned) during SSA certification to duplicate operational life (Ref. ILC Engineering Memorandum EM 83-1083). The following usage, reflecting requirements of significance to the waist bearing primary bracket, were documented during certification: <table border="1"> <thead> <tr> <th>Requirement</th> <th>S/AD</th> <th>Actual</th> </tr> </thead> <tbody> <tr> <td>Waist Flexion/Extension</td> <td>1234</td> <td>22176</td> </tr> <tr> <td>Waist Rotations</td> <td>2466</td> <td>12236</td> </tr> <tr> <td>Pressure Cycles</td> <td>300</td> <td>2045</td> </tr> <tr> <td>Don/Doff Cycles</td> <td>98</td> <td>445</td> </tr> <tr> <td>Pressure Hours</td> <td>458</td> <td>1646</td> </tr> <tr> <td>Walking Steps</td> <td>4320</td> <td>77760</td> </tr> </tbody> </table> Testing, during the screw thread engagement study, showed that the thread shear out ultimate safety factor for the primary restraint bracket screws is 4.0. C. Inspection - Components and material manufactured to ILC requirements at an approved supplier are documented from procurement through shipping by the supplier. ILC incoming receiving inspection verifies that the hardware received is as identified in the procurement documents, that no damage has occurred during shipment and that supplier certifications have been received which provide traceability information.	Requirement	S/AD	Actual	Waist Flexion/Extension	1234	22176	Waist Rotations	2466	12236	Pressure Cycles	300	2045	Don/Doff Cycles	98	445	Pressure Hours	458	1646	Walking Steps	4320	77760
Requirement	S/AD	Actual																							
Waist Flexion/Extension	1234	22176																							
Waist Rotations	2466	12236																							
Pressure Cycles	300	2045																							
Don/Doff Cycles	98	445																							
Pressure Hours	458	1646																							
Walking Steps	4320	77760																							

NAME P/N QTY	CRIT	FAILURE MODE & CAUSES	FAILURE EFFECT	RATIONALE FOR ACCEPTANCE
		104FM15		<p>The bracket castings are radiographically inspected to detect the presence of flaws prior to machining and magnetic particle inspected after machining. The brackets that are machined from plate stock are magnetic particle inspected to detect the presence of flaws.</p> <p>The following MIP's are performed during the waist assembly manufacturing process to assure that the failure mode causes are precluded from the fabricated item: Verification of the presence of screws during the primary restraint bracket screw torquing and threadlocking assembly operations. Helicoil installation is verified during source inspection at the supplier. Verification of loctite application.</p> <p>The following inspection points are performed at the LTA assembly level in accordance with ILC Document 0111-710112: 1. Visual inspection for material degradation. 2. Visual inspection for structural damage to the primary restraint bracket after proof pressure test.</p> <p>D. Failure History - None.</p> <p>E. Ground Turnaround - None, for every component within its limited life requirements.</p> <p>Every four years or 229 hours of manned pressurized time, during waist bearing maintenance the primary and secondary axial restraint brackets are removed and reinstalled during which time screw torque and loctite application are verified.</p> <p>F. Operational Use - Operational Use Crew Response - Pre/post-EVA : If not detected, no response. If detected audibly or tactily, troubleshoot problem. If no success, use spare LTA if available or terminate EVA prep. EVA : Single failure not detectable, no response. Special Training - No training specifically covers this failure mode. Operational Considerations - Not applicable.</p>

EXTRAVEHICULAR MOBILITY UNIT
SYSTEMS SAFETY REVIEW PANEL REVIEW
FOR THE
I-104 LOWER TORSO ASSEMBLY (LTA)
CRITICAL ITEM LIST (CIL)

EMU CONTRACT NO. NAS 9-97150

Prepared by: *[Signature]* 3/27/02
HS - Project Engineering

Approved by: *[Signature]* 12/26/02
NASA - SSA/SSM

[Signature]
HS - Reliability

[Signature] 5/17/02
NASA - EV/ISSM

[Signature] for *[Name]*
HS - Engineering Manager

[Signature] 5/17/02
NASA - S&ML

[Signature] 5/23/02
NASA - MOD

[Signature] 6/04/02
NASA - C/OW

[Signature] 6/13/02
NASA - Program Manager